of that series. Dr. Newell Arber, who supplied the original impulse for this work, laid the foundation for the author's position in this respect, and Miss Sargant's derivation of the Monocotyledons from the primitive Ranalean plexus is here accepted.

An explanation of the great structural reductions involved in the transition from terrestrial to aquatic life, and in the transference by hypothesis of so many families from the beginning to the end of the series of the Archichlamydeæ, became a necessity; so the author proposed her "Law of Loss," which has proved to be related closely to Dollo's "Law of Irreversibility" for animals. This rests on the principle that what is lost in the course of plant evolution can never be regained, and, if required again, "must be constructed afresh in some different mode." From this point of view the leaf-blades of several aquatic plants would be regarded as expansions of the petioles, and much light would be thrown on the many difficult questions involved in the interpretation of the flowers.

The author's position regarding natural selection is discussed, so far as it is determined by aquatic plants. The principle is almost protean in its appearances. When we think we have disposed of it in one shape, it arises in another. If, like Dr. Willis, we exclude it in the case of the genera and species of the Podostemaceæ, it turns up again as the principal factor in the adaptation of the group for life in rapid waters. Dr. Agnes Arber shares with many others her difficulties in accepting whole-heartedly the principle May it not be possible to assume that these difficulties would disappear if we broadened the basis of the theory? Whilst supporting Darwin through so many years, Hooker was holding a view of divergence, under the name of "centrifugal variation" (really a conception of differentiation), that was directly opposed to important points of the theory. Yet he considered that the greatest hope of the investigator lay in the *general* lines marked out by Darwin.

However that may be, we are reminded by the author of this book of an evolutionary idea, both old and new, that is capable of great development. . The principle that what organisms gain in specialisation they lose in plasticity presents us with quite another way of viewing evolution—a view in which progression offers itself as a succession of lost opportunities. Progress in one direction involves the closing of the gates in "countless other directions," the possibilities of choice ever narrowing as we go up the scale. It is suggested that this would be impossible but for the inheritance of acquired characters, bound up, probably, with the inheritance of unconscious memory. At all events, it presupposes a primeval era of plasticity in which heredity had but little power. The line of thought is similar to that followed by Beccari in his theory of plasmation. Here a long vista opens up, and at its distant end lie the problems connected with the origin of the great groups of the plant world.

H. B. GUPPY.

The Behaviour of Beetles.

The Glow-worm and other Beetles. By J. Henri Fabre. Translated by Alexander Teixeira de Mattos. Pp. viii + 488. (London: Hodder and Stoughton, Ltd., 1919.) Price 8*s.* 6*d.* net.

THIS is the second volume on beetles in the complete English edition of Henri Fabre's entomological works. The first essay, "The Glow-worm," which gives its name to the book, did not form part of the "Souvenirs Entomologiques," but was written for translation into English towards the close of the veteran naturalist's life. Several chapters, like this first one, have already seen the light in English, but most of the book is fresh, and it is very convenient to have the studies on beetles brought together. Eventually there will be four volumes on beetles. The experienced translator, Mr. Alexander Teixeira de Mattos, has done his work with great skill.

These are wonderful stories. The glow-worm tweaks a snail with its sharp mandibles, and administers an anæsthetic; a number of other glow-worms hasten to the repast and fall to; the flesh is converted by exuded ferment into a sort of gruel, and the fluid is sucked up by the hollow jaws. We suspect that there is some inaccuracy in Fabre's account; it seems clear, for instance, that the fluid food enters the gullet by the mouth, and not *via* the mandibles. In any case, Fabre's observations must be compared with those of Bugnion and Miss Kathleen Haddon. In regard to the luminescence Fabre was cautious:—

> "From start to finish, the glow-worm's life is one great orgy of light. The eggs are luminous; the grubs likewise. The full-grown females are magnificent light-houses, the adult males retain the glimmer which the grubs already possessed. We can understand the object of the feminine beacon; but of what use is all the rest of the pyrotechnic display? To my great regret, I cannot tell. It is and will be, for many a day to come, perhaps for all time, the secret of animal physics, which is deeper than the physics of the books."

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The close of this frank admission of ignorance has the characteristic Fabre touch, the precise point of which is not very obvious. Bio-chemistry and bio-physics are both very young, but they have already had their triumphs, which pass automatically into the contemned books. What is wrong with the physics of the books except that naturalists do not read it?

The succeeding five chapters deal with the remarkable life-histories of sitares, oil-beetles, and the like, and they certainly demand the reader's close attention. It is easier to follow the fine study of the capricorn (the grub of the Cerambyx beetle), which burrows in the stem of the oak.

> "This grub, so poor in sensory organs, gives us with its prescience no little food for reflection. It knows that the coming beetle will not be able to cut himself a road through the oak, and it bethinks itself of opening one for him at its own risk and peril. It knows that the Cerambyx, in his stiff armour, will never be able to turn and make for the orifice of the cell; and it takes care to fall into its nymphal sleep with its head to the door. It knows how soft the pupa's flesh will be and upholsters the bedroom with velvet."

Here we have an instance of Fabre's strength and weakness; the facts are so interesting; the discovery of them was a triumph; the exposition of them is extraordinarily vivid; but the interpretation seems wildly anthropomorphic. We do not, we confess, understand instinctive behaviour; but we feel sure that the "inimitable observer," as Darwin called him, was off the scent. We get tired of this "knowing" and "bethinking," all the more because we doubt whether Fabre believed in it himself. "It knows the future with a clear vision," he says, "or, to be accurate, behaves as though it knew the future." But even this wobbling between inaccurate and accurate expression might have been accepted with good humour—a little fly in the fine ointment of fact for which every naturalist is grateful—had not Fabre made us wince by such *obiter dicta* as "now that the evolutionists' interpretations of instinct have been recognised as worthless."

One of the fine qualities of Fabre's essays is the way in which they raise questions which we cannot answer. How is it that the sawfly Sirex, which undergoes metamorphosis not far from the centre of the trunk of the tree, makes its way out to the light by the shortest route? Over and over again we find these puzzling problems stated; one attempt at solution is tested and then another, only to be rejected; and then the author gives it up for the time being: "I leave the matter to the conscientious masters, to the experts who are able to say: I do not know." This is much more educative than a prejudiced dismissal of evolutionism.

Biologically of great interest is the essay on insect colouring, in which Fabre expounds and illustrates the theory that various bright colours are due to a utilisation of ammonium urate or some related nitrogenous waste-product.

> "While the larvæ of the Hunting Wasps, unable to do better, stipple themselves with uric acid, there are plenty of industrious creatures that are able to make themselves a superb dress by preserving their excretions in spite of their own open sewers. With a view to self-embellishment [again the anthropomorphic taint], they collect and treasure up the dross which others hasten to expel. They turn filth into finery."

When he got hold of an attractive idea, Fabre often let himself go, and we like him none the less for that.

> "Nature, that sublime economist, delights in these vast antitheses which upset all our conceptions of the values of things. Of a pinch of common charcoal she makes a diamond; . . . of the filthy waste products of the organism she makes the splendours of the insect and the bird. The metallic marvels of the Buprestis and the Ground-Beetle; the amethyst, ruby, sapphire, emerald and topaz of the Humming-Bird; glories which would exhaust the language of the lapidary jeweller: what are they in reality? Answer: A drop of urine."

It seems almost profane to ask how many of the pigments of birds are known to be chemically related to urates; it seems niggling to ask whether the picturesque reference to sapphire and emerald is relevant at all, since these particular colours in the humming-bird are surely due to physical sculpturing rather than to any number of drops of urine.

The Fabre we like best is the patient and ingenious and sympathetic observer who tells us, in other chapters, of the accomplishments of the burying-beetles and their not less marvellous limitations, of "death-feigning" in Scarites and Buprestis, of animal hypnosis at higher levels, of the supposed suicide of scorpions, and of the *vie intime* of half a hundred beetles. Was there ever such an observer? We suppose Réaumur and two or three others might be mentioned. But was there ever any other observer of this rank who could tell his story so that we fancy ourselves seeing what he saw? We know of none. And so we come back to our homage to Fabre.

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